Differential Eq By H K Dass

This monograph explores nonoscillation and existence of positive solutions for functional differential equations and describes their applications to maximum principles, boundary value problems and stability of these equations. In view of this objective the volume considers a wide class of equations including, scalar equations and systems of different types, equations with variable types of delays and equations with variable deviations of the argument. Each chapter includes an introduction and preliminaries, thus making it complete. Appendices at the end of the book cover reference material. Nonoscillation Theory of Functional Differential Equations with Applications is addressed to a wide audience of researchers in mathematics and practitioners.

Elementary Differential Equations presents the standard material in a first course on di?erential equations, including all standard methods which have been a part of the subject since the time of Newton and the Bernoulli brothers. The emphasis in this book is on theory and methods and di?erential equations as a part of analysis. Di?erential equations is worth studying, rather than merely some recipes to be used in physical science. The text gives substantial emphasis to methods which are generally presented ?rst with theoretical considerations following. Essentially all proofs of the theorems used are included, making the book more useful as a reference. The book mentions the main computer algebra systems, yet the emphasis is placed on MATLAB and numerical methods which include graphing the solutions and obtaining tables of values. Featured applications are easily understood. Complete explanations of the mathematics and emphasis on methods for ?nding solutions are included.

Applied Differential Equations with Boundary Value Problems presents a contemporary treatment of ordinary differential equations (ODEs) and an introduction to partial differential equations (PDEs), including their applications in engineering and the sciences. This new edition of the author's popular textbook adds coverage of boundary value problems. The text covers traditional material, along with novel approaches to mathematical modeling that harness the capabilities of numerical algorithms and popular computer software packages. It contains practical techniques for solving the equations as well as corresponding codes for numerical solvers. Many examples and exercises help students master effective solution techniques, including reliable numerical approximations. This book describes differential equations in the context of applications and presents the main techniques needed for modeling and systems analysis. It teaches students how to formulate a mathematical model, solve differential equations

analytically and numerically, analyze them qualitatively, and interpret the results.

Stability of Differential Equations with Aftereffect presents stability theory for differential equations concentrating on functional differential equations with delay, integro-differential equations, and related topics. The authors provide background material on the modern theory of functional differential equations and introduce some new flexible methods for investigating the asymptotic behaviour of solutions to a range of equations. The treatment also includes some results from the authors' research group based at Perm and provides a useful reference text for graduates and researchers working in mathematical and engineering science.

Analysis and Partial Differential Equations on Manifolds, Fractals and Graphs

An Introduction

Partial Differential Equation Based Methods in Medical Image Processing

Singular Nonlinear Partial Differential Equations

This Special Issue collects the latest results on differential/difference equations, the mathematics of networks, and their applications to engineering and physical phenomena. It features nine high-quality papers that were published with original research results. The Special Issue brings together mathematicians with physicists, engineers, as well as other scientists.

This volume provides an introduction to the properties of functional differential equations and their applications in diverse fields such as immunology, nuclear power generation, heat transfer, signal processing, medicine and economics. In particular, it deals with problems and methods relating to systems having a memory (hereditary systems). The book contains eight chapters. Chapter 1 explains where functional differential equations come from and what sort of problems arise in applications. Chapter 2 gives a broad introduction to the basic principle involved and deals with systems having discrete and distributed delay. Chapters 3-5 are devoted to stability problems for retarded, neutral and stochastic functional differential equations. Problems of optimal control and estimation are considered in Chapters 6-8. For applied mathematicians, engineers, and physicists whose work involves mathematical modeling of hereditary systems. This volume can also be recommended as a supplementary text for graduate students who wish to become better acquainted with the properties and applications of functional differential equations.

Differential Equations presents the basics of differential equations. With equal emphasis on theoretical and practical concepts, the book provides a balanced coverage of all topics essential to master the subject at the undergraduate level.

As a relatively new area in mathematics, stochastic partial differential equations (PDEs) are still at a tender age and have not yet received much attention in the mathematical community. Filling the void of an introductory text in the field, Stochastic Partial Differential Equations introduces PDEs to students familiar with

basic probability theor
Differential Equations
Stability of Differential Equations with Aftereffect
Robust Numerical Methods for Singularly Perturbed Differential Equations
Recent Developments in the Solution of Nonlinear Differential Equations
Analysis and Differential Equations

This book groups material that was used for the Marrakech 2002 School on Delay Di?erential Equations and Applications. The school was held from September 9-21 2002 at the Semlalia College of Sciences of the Cadi Ayyad University, Marrakech, Morocco. 47 participants and 15 instructors originating from 21 countries attended the school. Fin- cial limitations only allowed support for part of the people from Africa andAsiawhohadexpressedtheirinterestintheschoolandhadhopedto come. Theschoolwassupportedby?nancementsfromNATO-ASI(Nato advanced School), the International Centre of Pure and Applied Mat- matics (CIMPA, Nice, France) and Cadi Ayyad University. The activity of the school consisted in courses, plenary lectures (3) and communi- tions (9), from Monday through Friday, 8. 30 am to 6. 30 pm. Courses were divided into units of 45mn duration, taught by block of two units, with a short 5mn break between two units within a block, and a 25mn break between two blocks. The school was intended for mathematicians willing to acquire some familiarity with delay di?erential equations or enhance their knowledge on this subject. The aim was indeed to extend the basic set of knowledge, including ordinary di?erential equations and semilinearevolutionequations, suchasforexamplethedi?usion-reaction equations arising in morphogenesis or the Belouzov-Zhabotinsky ch- ical reaction, and the classic approach for the resolution of these eq- tions by perturbation, to equations having in addition terms involving past values of the solution.

Explore Theory and Techniques to Solve Physical, Biological, and Financial Problems Since the first edition was published, there has been a surge of interest in stochastic partial differential equations (PDEs) driven by the Lévy type of noise. Stochastic Partial Differential Equations, Second Edition incorporates these recent developments and improves the presentation of material. New to the Second Edition Two sections on the Lévy type of stochastic integrals and the related stochastic differential equations in finite dimensions Discussions of Poisson random fields and related stochastic integrals, the solution of a stochastic heat equation with Poisson noise, and mild solutions to linear and nonlinear parabolic equations with Poisson noises Two sections on linear and semilinear wave equations driven by the Poisson type of noises Treatment of the Poisson stochastic integral in a Hilbert space and mild solutions of stochastic evolutions with Poisson noises Revised proofs and new theorems, such as explosive solutions of stochastic reaction diffusion equations Additional applications of stochastic PDEs to population biology and finance Updated section on parabolic equations and related elliptic problems in Gauss–Sobolev spaces The book covers basic theory as well as computational and analytical techniques to solve physical,

biological, and financial problems. It first presents classical concrete problems before proceeding to a unified theory of stochastic evolution equations and describing applications, such as turbulence in fluid dynamics, a spatial population growth model in a random environment, and a stochastic model in bond market theory. The author also explores the connection of stochastic PDEs to infinite-dimensional stochastic analysis.
Suitable for advanced undergraduates and graduate students, this text introduces the stability theory and asymptotic behavior of solutions of linear and nonlinear differential equations. 1953 edition.
Impulsive differential equations have been the subject of intense investigation in the last 10-20 years, due to the wide possibilities for their application in numerous fields of science and technology. This new work presents a systematic exposition of the results solving all of the more important problems in this field.

Applied Theory of Functional Differential Equations
Applied Differential Equations with Boundary Value Problems
Extrema of Nonlocal Functionals and Boundary Value Problems for Functional Differential Equations
Complex Analytic Methods for Partial Differential Equations
Recent Advances in Scientific Computing and Partial Differential Equations

Differential Equations is a collection of papers from the "Eight Fall Conference on Differential Equations" held at Oklahoma State University in October 1979. The papers discuss hyperbolic problems, bifurcation function, boundary value problems for Lipschitz equations, and the periodic solutions of systems of ordinary differential equations. Some papers deal with the existence of periodic solutions for nonlinearly perturbed conservative systems, the saddle-point theorem, the periodic solutions of the forced pendulum equation, as well as the structural identification (inverse) problem for illness-death processes. One paper presents an elementary proof of the work of deOliveira and Hale, and applies the stability for autonomous systems in the critical case of one zero root. Another paper explains the necessary and sufficient conditions for structural identification prior to application in states of illness-death processes. An illness-death process is a continuous Markov model with n illness (transient) states each having one (and only one) transfer into a death state. The paper examines two theorems whether these apply to an illness-death process under certain given elements. The collection is an ideal source of reference for mathematicians, students, and professor of calculus and advanced mathematics.

A new edition of this classic work, comprehensively revised to present exciting new developments in this important subject

The study of numerical methods for solving ordinary differential equations is constantly developing and regenerating, and this third edition of a popular classic volume, written by one of the world's leading experts in the field, presents an account of the subject which reflects both its historical and well-established place in computational science and its vital role as a cornerstone of modern applied mathematics. In addition to serving as a broad and comprehensive study of numerical methods for initial value problems, this book contains a special emphasis on Runge-Kutta methods by the mathematician who transformed the subject into its modern form dating from his classic 1963 and 1972 papers. A second feature is general linear methods which have now matured and grown from being a framework for a unified theory of a wide range of diverse numerical schemes to a source of new and practical algorithms in their own right. As the founder of general linear method research, John Butcher has been a leading contributor to its development; his special role is reflected in the text. The book is written in the lucid style characteristic of the author, and combines enlightening explanations with rigorous and precise analysis. In addition to these anticipated features, the book breaks new ground by including the latest results on the highly efficient G-symplectic methods which compete strongly with the well-known symplectic Runge-Kutta methods for long-term integration of conservative mechanical systems. Key features: ?? Presents a comprehensive and detailed study of the subject ?? Covers both practical and theoretical aspects ?? Includes widely accessible topics along with sophisticated and advanced details ?? Offers a balance between traditional aspects and modern developments This third edition of Numerical Methods for Ordinary Differential Equations will serve as a key text for senior undergraduate and graduate courses in numerical analysis, and is an essential resource for research workers in applied mathematics, physics and engineering.

Surveys and summaries of the latest research in numerical analysis, optimization, computer algebra and scientific computing.

The book covers the latest research in the areas of mathematics that deal the properties of partial differential equations and stochastic processes on spaces in connection with the geometry of the underlying space. Written by experts in the field, this book is a valuable tool for the advanced

mathematician.

Stochastic Partial Differential Equations, Second Edition
Impulsive Differential Equations
Elementary Differential Equations
Stability Theory of Differential Equations
Computational Techniques for Differential Equations

Textbook with a unique approach that integrates analysis and numerical methods and includes modelling to address real-life problems.

This book presents advanced methods of integral calculus and the classical theory of the ordinary and partial differential equations. It provides explicit solutions of linear and nonlinear differential equations and implicit solutions with discrete approximations. Differential equations that could not be explicitly solved are discussed with special functions such as Bessel functions. New functions are defined from differential equations. Laguerre, Hermite and Legendre orthonormal polynomials as well as several extensions are also considered. It is illustrated by examples and graphs of functions, with each chapter containing exercises solved in the last chapter.

This is an introductory text for beginners who have a basic knowledge of complex analysis, functional analysis and partial differential equations. Riemann and Riemann-Hilbert boundary value problems are discussed for analytic functions, for inhomogeneous Cauchy-Riemann systems as well as for generalized Beltrami systems. Related problems such as the Poincar, problem, pseudoparabolic systems and complex elliptic second order equations are also considered. Estimates for solutions to linear equations existence and uniqueness results are thus available for related nonlinear problems; the method is explained by constructing entire solutions to nonlinear Beltrami equations. Often problems are discussed just for the unit disc but more general domains, even of multiply connectivity, are involved.

Variational Techniques for Elliptic Partial Differential Equations, intended for graduate students studying applied math, analysis, and/or numerical analysis, provides the necessary tools to understand the structure and solvability of elliptic partial differential equations. Beginning with the necessary definitions and theorems from distribution theory, the book gradually builds the functional analytic framework for studying elliptic PDE using variational formulations. Rather than introducing all of the prerequisites in the first chapters, it is the introduction of new problems which motivates the development of the associated analytical tools. In this way the student who is encountering this material for the first time will be aware of exactly what theory is needed, and for which problems. Features A detailed and rigorous development of the theory of Sobolev spaces on Lipschitz domains, including the trace operator and the normal component of vector fields An integration of functional analysis concepts involving Hilbert spaces and the problems which can be solved with these concepts, rather than separating the two Introduction to the analytical tools needed for physical problems of interest like time-harmonic waves, Stokes and Darcy flow, surface differential equations, Maxwell cavity problems, etc. A variety of problems which serve to reinforce and expand upon the material in each chapter, including applications in fluid and solid mechanics

Splitting Methods for Partial Differential Equations with Rough Solutions
Partial Differential Equations
International Conference on the Occasion of Stanley Osher's 60th Birthday, December 12-15, 2002, Hong Kong Baptist University, Hong Kong
Analysis and MATLAB Programs

Stochastic Partial Differential Equations

The volume is from the proceedings of the international conference held in celebration of Stanley Osher's sixtieth birthday. It presents recent developments and exciting new directions in scientific computing and partial differential equations for time dependent problems and their interplay with other fields, such as image processing, computer vision and graphics. Over the past decade, there have been very rapid developments in the field. This volume emphasizes the strong interaction of advanced mathematics with real-world applications and algorithms. The book is suitable for graduate students and research mathematicians interested in scientific computing and partial differential equations.

This book provides a clear summary of the work of the author on the construction of nonstandard finite difference schemes for the numerical integration of differential equations. The major thrust of the book is to show that discrete models of differential equations exist such that the elementary types of numerical instabilities do not occur. A consequence of this result is that in general bigger step-sizes can often be used in actual calculations and/or finite difference schemes can be constructed that are conditionally stable in many instances whereas in using standard techniques no such schemes exist. The theoretical basis of this work is centered on the concepts of “exact” and “best” finite difference schemes. In addition, a set of rules is given for the discrete modeling of derivatives and nonlinear expressions that occur in differential equations. These rules often lead to a unique nonstandard finite difference model for a given differential equation. Contents:IntroductionNumerical InstabilitiesNonstandard Finite-Difference SchemesFirst-Order ODE'sSecond-Order, Nonlinear Oscillator EquationsTwo First-Order, Coupled Ordinary Differential EquationsPartial Differential EquationsSchrädinger Differential EquationsSummary and DiscussionAppendices: Difference EquationsLinear Stability AnalysisDiscrete WKB MethodBibliographyIndex Readership: Applied mathematicians (numerical analysis and modeling). keywords:Finite Difference Techniques;Numerical Schemes for Differential Equations;Numerical Instabilities;Nonstandard Schemes;Exact Finite Difference Schemes;Best Finite Difference Schemes;Denominator Functions;Linear Stability Analysis;Discrete WKB Method “This book contains a clear presentation of nonstandard finite difference schemes for the numerical integration of differential equations. A set of rules for constructing nonstandard finite difference schemes is also presented. An important feature of the book is the illustration of the various discrete modeling principles, by their application to a large number of both ordinary and partial differential equations.” Mathematical Reviews

The non-local functional is an integral with the integrand depending on the unknown function at different values of the argument. These types of functionals have different applications in physics, engineering and sciences. The Euler type equations that arise as necessary conditions of extrema of non-local functionals are the functional differential equations. The book is dedicated to systematic study of variational calculus for non-local functionals and to theory of boundary value problems for functional differential equations. There are described different necessary and some sufficient conditions for extrema of non-local functionals. Theorems of existence and uniqueness of solutions to many kinds of boundary value problems for functional differential equations are proved. The spaces of solutions to these problems are, as a rule, Sobolev spaces and it is not often possible to apply the analytical methods for solution of these problems. Therefore

it is important to have approximate methods for their solution. Different approximate methods of solution of boundary value problems for functional differential equations and direct methods of variational calculus for non-local functionals are described in the book. The non-local functional is an integral with the integrand depending on the unknown function at different values of the argument. These types of functionals have different applications in physics, engineering and sciences. The Euler type equations that arise as necessary conditions of extrema of non-local functionals are the functional differential equations. The book is dedicated to systematic study of variational calculus for non-local functionals and to theory of boundary value problems for functional differential equations. There are described different necessary and some sufficient conditions for extrema of non-local functionals. Theorems of existence and uniqueness of solutions to many kinds of boundary value problems for functional differential equations are proved. The spaces of solutions to these problems are, as a rule, Sobolev spaces and it is not often possible to apply the analytical methods for solution of these problems. Therefore it is important to have approximate methods for their solution. Different approximate methods of solution of boundary value problems for functional differential equations and direct methods of variational calculus for non-local functionals are described in the book.
Differential Equations are very important tools in Mathematical Analysis. They are widely found in mathematics itself and in its applications to statistics, computing, electrical circuit analysis, dynamical systems, economics, biology, and so on. Recently there has been an increasing interest in and widely-extended use of differential equations and systems of fractional order (that is, of arbitrary order) as better models of phenomena in various physics, engineering, automatization, biology and biomedicine, chemistry, earth science, economics, nature, and so on. Now, new unified presentation and extensive development of special functions associated with fractional calculus are necessary tools, being related to the theory of differentiation and integration of arbitrary order (i.e., fractional calculus) and to the fractional order (or multi-order) differential and integral equations. This book provides learners with the opportunity to develop an understanding of advancements of special functions and the skills needed to apply advanced mathematical techniques to solve complex differential equations and Partial Differential Equations (PDEs). Subject matters should be strongly related to special functions involving mathematical analysis and its numerous applications. The main objective of this book is to highlight the importance of fundamental results and techniques of the theory of complex analysis for differential equations and PDEs and emphasizes articles devoted to the mathematical treatment of questions arising in physics, chemistry, biology, and engineering, particularly those that stress analytical aspects and novel problems and their solutions. Specific topics include but are not limited to Partial differential equations Least squares on first-order system Sequence and series in functional analysis Special functions related to fractional (non-integer) order control systems and equations Various special functions related to generalized fractional calculus Operational method in fractional calculus Functional analysis and operator theory Mathematical physics Applications of numerical analysis and applied mathematics Computational mathematics Mathematical modeling This book provides the recent developments in special functions and differential equations and publishes high-quality, peer-reviewed book chapters in the area of nonlinear analysis, ordinary differential equations, partial differential equations, and related applications.

Lie's Theory on Solvability of Ordinary Differential Equations
Variational Techniques for Elliptic Partial Differential Equations
An Introductory Text
Numerical Methods for Ordinary Differential Equations
The Vladimir Maz'ya Anniversary Volume

Differential Equations:Pearson Education India

This open access book features a selection of high-quality papers from the presentations at the International Conference on Spectral and High-Order Methods 2018, offering an overview of the depth and breadth of the activities within this important research area. The carefully reviewed papers provide a snapshot of the state of the art, while the extensive bibliography helps initiate new research directions.

A Sobolev gradient of a real-valued functional on a Hilbert space is a gradient of that functional taken relative to an underlying Sobolev norm. This book shows how descent methods using such gradients allow a unified treatment of a wide variety of problems in differential equations. For discrete versions of partial differential equations, corresponding Sobolev gradients are seen to be vastly more efficient than ordinary gradients. In fact, descent methods with these gradients generally scale linearly with the number of grid points, in sharp contrast with the use of ordinary gradients. Aside from the first edition of this work, this is the only known account of Sobolev gradients in book form. Most of the applications in this book have emerged since the first edition was published some twelve years ago. What remains of the first edition has been extensively revised. There are a number of plots of results from calculations and a sample MatLab code is included for a simple problem. Those working through a fair portion of the material have in the past been able to use the theory on their own applications and also gain an appreciation of the possibility of a rather comprehensive point of view on the subject of partial differential equations.

Nonlinear differential equations are ubiquitous in computational science and engineering modeling, fluid dynamics, finance, and quantum mechanics, among other areas. Nowadays, solving challenging problems in an industrial setting requires a continuous interplay between the theory of such systems and the development and use of sophisticated computational methods that can guide and support the

theoretical findings via practical computer simulations. Owing to the impressive development in computer technology and the introduction of fast numerical methods with reduced algorithmic and memory complexity, rigorous solutions in many applications have become possible. This book collects research papers from leading world experts in the field, highlighting ongoing trends, progress, and open problems in this critically important area of mathematics.

Periodic Solutions and Applications

Selected Papers from the ICOSAHOM Conference, London, UK, July 9-13, 2018

Nonstandard Finite Difference Models of Differential Equations

Special Functions and Analysis of Differential Equations

ANALYTIC PARTIAL DIFFERENTIAL EQUATIONS

This new edition incorporates new developments in numerical methods for singularly perturbed differential equations, focusing on linear convection-diffusion equations and on nonlinear flow problems that appear in computational fluid dynamics.

Fuzzy differential functions are applicable to real-world problems in engineering, computer science, and social science. That relevance makes for rapid development of new ideas and theories. This volume is a timely introduction to the subject that describes the current state of the theory of fuzzy differential equations and inclusions and provides a systematic account of recent developments. The chapters are presented in a clear and logical way and include the preliminary material for fuzzy set theory; a description of calculus for fuzzy functions, an investigation of the basic theory of fuzzy differential equations, and an introduction to fuzzy differential inclusions.

Partial Differential Equations presents a balanced and comprehensive introduction to the concepts and techniques required to solve problems containing unknown functions of multiple variables. While focusing on the three most classical partial differential equations (PDEs)—the wave, heat, and Laplace equations—this detailed text also presents a broad practical perspective that merges mathematical concepts with real-world application in diverse areas including molecular structure, photon and electron interactions, radiation of electromagnetic waves, vibrations of a solid, and many more. Rigorous pedagogical tools aid in student comprehension; advanced topics are introduced frequently, with minimal technical jargon, and a wealth of exercises reinforce vital skills and invite additional self-study. Topics are presented in a logical progression, with major concepts such as wave propagation, heat and diffusion, electrostatics, and quantum mechanics placed in contexts familiar to students of various fields in science and engineering. By understanding the properties and applications of PDEs, students will be equipped to better analyze and interpret central processes of the natural world.

This volume forms a record of the lectures given at this International Conference. Under the general heading of the equations of mathematical physics, contributions are included on a broad range of topics in the theory and applications of ordinary and partial differential equations, including both linear and non-linear equations. The topics cover a wide variety of methods (spectral, theoretical, variational, topological, semi-group), and a equally wide variety of equations including the Laplace equation, Navier-Stokes equations, Boltzmann's equation, reaction-diffusion equations, Schroedinger equations and certain non-linear wave equations. A number of papers are devoted to multi-particle scattering theory, and to inverse theory. In addition, many of the plenary lectures contain a significant amount of survey material on a wide variety of these topics.

Proceedings of the NATO Advanced Study Institute held in Marrakech, Morocco, 9-21 September 2002

Generalized Ordinary Differential Equations

Foundations of Computational Mathematics, Hong Kong 2008

Mathematical Modeling using Differential Equations, and Network Theory

Modeling, Analysis, Computation

This volume includes several invited lectures given at the International Workshop "Analysis, Partial Differential Equations and Applications", held at the Mathematical Department of Sapienza University of Rome, on the occasion of the 70th birthday of Vladimir G. Maz'ya, a renowned mathematician and one of the main experts in the field of pure and applied analysis. The book aims at spreading the seminal ideas of Maz'ya to a larger audience in faculties of sciences and engineering. In fact, all articles were inspired by previous works of Maz'ya in several frameworks, including classical and contemporary problems connected with boundary and initial value problems for elliptic, hyperbolic and parabolic operators, Schrödinger-type equations, mathematical theory of elasticity, potential theory, capacity, singular integral operators, p-Laplacians, functional analysis, and approximation theory. Maz'ya is author of more than 450 papers and 20 books. In his long career he obtained many astonishing and frequently cited results in the theory of harmonic potentials on non-smooth domains, potential and capacity theories, spaces of functions with bounded variation, maximum principle for higher-order elliptic equations, Sobolev multipliers, approximate approximations, etc. The topics included in this volume will be particularly useful to all researchers who are interested in achieving a deeper understanding of the large expertise of Vladimir Maz'ya.

Computational Techniques for Differential Equations

The aim of this book is to put together all the results that are known about the existence of formal, holomorphic and singular solutions of singular non linear partial differential equations.

The contemporary approach of J Kurzweil and R Henstock to the Perron integral is applied to the theory of ordinary differential equations in this book. It focuses mainly on the problems of continuous dependence on parameters for ordinary differential equations. For this purpose, a generalized form of the integral based on integral sums is defined. The theory of generalized differential equations based on this integral is then used, for example, to cover differential equations with impulses or measure differential equations. Solutions of generalized differential equations are found to be functions of bounded variations.The book may be used for a special undergraduate course in mathematics or as a postgraduate text. As there are currently no other special research monographs or textbooks on this topic in English, this book is an invaluable reference text for those interested in this field.

Handbook of First-Order Partial Differential Equations
Sobolev Gradients and Differential Equations
Theoretical Tools and Advanced Applications
Nonoscillation Theory of Functional Differential Equations with Applications
Delay Differential Equations and Applications

Operator splitting (or the fractional steps method) is a very common tool to analyze nonlinear partial differential equations both numerically and analytically. By applying operator splitting to a complicated model one can often split it into simpler problems that can be analyzed separately. In this book one studies operator splitting for a family of nonlinear evolution equations, including hyperbolic conservation laws and degenerate convection-diffusion equations. Common for these equations is the prevalence of rough, or non-smooth, solutions, e.g., shocks. Rigorous analysis is presented, showing that both semi-discrete and fully discrete splitting methods converge. For conservation laws, sharp error estimates are provided and for convection-diffusion equations one discusses a priori and a posteriori correction of entropy errors introduced by the splitting. Numerical methods include finite difference and finite volume methods as well as front tacking. The theory is illustrated by numerous examples. There is a dedicated web page that provides MATLAB codes for many of the examples. The book is suitable for graduate students and researchers in pure and applied mathematics, physics, and engineering.

This book contains about 3000 first-order partial differential equations with solutions. New exact solutions to linear and nonlinear equations are included. The text pays special attention to equations of the general form, showing their dependence upon arbitrary functions. At the beginning of each section, basic solution methods for the corresponding types of differential equations are outlined and specific examples are considered. It presents equations and their applications, including differential geometry, nonlinear mechanics, gas dynamics, heat and mass transfer, wave theory and much more. This handbook is an essential reference source for researchers, engineers and students of applied mathematics, mechanics, control theory and the engineering sciences.

Differential Equations:

Convection-Diffusion-Reaction and Flow Problems

Spectral and High Order Methods for Partial Differential Equations ICOSAHOM 2018
Analysis, Partial Differential Equations and Applications
Theory of Fuzzy Differential Equations and Inclusions